

PATENT ABSTRACTS OF JAPAN

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(54) THERMAL RECORDING MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a thermal recording medium which shows good ink receiving characteristics during thermal transfer recording and the capability of recording without generating a sticking phenomenon or printing scums during thermal recording and besides, giving rise to a blocking phenomenon, in the thermal recording medium having at least one kind or more of a thermal recording layer which contains at least one kind or more of an electron-donating and normally colorless or pale-color dye precursor and an electron-receiving developer which makes the dye precursor develop a color through a chemical reaction during heating, laminated on a support.

SOLUTION: This thermal recording medium contains polyolefin resin particles in an overcoat layer and also one kind or more of either of an acrylic resin, a urethane resin or an SBR latex. In addition, even during thermal transfer recording, this medium exhibits good ink receiving properties and records data during thermal recording without generating a sticking phenomenon and printing scums. Thus this thermal recording medium shows excellent blocking characteristics.

LEGAL STATUS

[Date of request for examination]

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[Patent number]

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CLAIMS

[Claim(s)]

[Claim 1] On a base material, electron-donative [at least one or more sorts of] usually The color precursor of colorlessness thru/or light color, In the thermal recording medium containing the developer of electronic receptiveness made to color this color precursor at the time of heating which prepared the heat-sensitive recording layer which consists of at least one or more layers an overcoat layer -- a low consistency polyolefine system resin particle -- containing -- in addition -- and the thermal recording medium characterized by glass transition temperature (Tg) containing any one or more sorts of acrylic resin [20 degrees C or less] -60 degrees C or more, urethane resin, and the SBR latex.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the thermal recording medium which prepared the heat-sensitive recording layer and the overcoat layer with hot printing acceptance nature on the base material.

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PRIOR ART

[Description of the Prior Art] Generally a thermal recording medium is what prepared the heat-sensitive recording layer which consists of the thermal recording component which uses as a principal component the developer of electronic receptiveness which electron-donative makes color this color precursor usually in response to a base material top the color precursor of colorlessness thru/or light color, and the time of heating, By heating with a thermal head (heat head), a heat stylus, laser light, etc., a color precursor and a developer carry out an instant reaction, a coloring image is obtained, and it is indicated by JP,43-4160,B, JP,45-14039,B, etc. [0003] Such a thermal recording medium can be recorded with comparatively easy equipment, has advantages, like that maintenance is easy and there is no generating of the noise, and is used for wide range fields, such as an automatic vending machine of a measurement recorder, facsimile, a printer, the terminal of a computer, a label, and a ticket. A thermal recording medium is used also for financial-related record forms, such as receipts, such as gas, a waterworks, and an electricity bill, a use specification of ATM of a financial institution, and various receipts, especially in recent years. As mentioned above, in addition to coloring in monochrome, the demand to the multicolor thermal recording medium which two or more sorts of color tones can be made to color by the difference in heating temperature has also been increasing as an application is diversified.

[0004] On the other hand, from the tooth back of the sensible-heat ribbon which applied the ink of thermofusion nature on the base material, heating according to an information signal is performed with a heat head, and the thermal imprint recording method which imprints the ink which fused and fused ink on a record medium is also held using comparatively easy equipment. A thermal imprint recording method can perform multicolor printing comparatively easily by using two or more ink ribbons from which a color tone differs. On the other hand, two or more ink ribbons must be used and the need from the flow of cost reduction in recent years and trash reduction to thermal recording without the need for an ink ribbon and its supplement exchange has been increasing.

[0005] A thermal recording medium which can be used for both methods is desired without often performing these thermal recording equipment and thermal-transfer-recording equipment from the similarity on structure using the same equipment, and caring about the difference in a recording method in the transition stage of shift of a present recording method.

[0006] The ink ribbon side and record medium which were pushed by the thermal head need to stick completely, and it is necessary to receive ink to homogeneity, and if the property which each record medium is expected is described briefly, it is necessary to fully bind with a thermal-transfer-recording medium so that there may be no dedropping. Therefore, what applied the polymer which has the binder component of ink and sufficient binding property on the base material is used widely. On the other hand, by the thermal recording medium, it is required to prepare the heat-sensitive recording layer colored with heating on a base material.

[0007] Therefore, as for the record medium corresponding to these two recording methods, it is desirable to prepare a heat-sensitive recording layer on a base material, and to prepare a hot printing acceptance layer on it. When such a record medium is used as a thermal recording medium, since materials, such as a high polymer of hot printing ink acceptance nature, are used,

it is easy to produce sticking, printing dregs, etc., and in order to carry out amelioration prevention of these, concomitant use of a pigment, lubricant, etc. is needed. On the other hand, concomitant use of a pigment or lubricant makes surface smooth nature and a binding property with ink fall, and is not desirable as a thermal-transfer-recording medium. Therefore, there is no record medium with which it can still be satisfied of two recording methods enough.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The purpose of this invention has good ink acceptance nature also at the time of thermal transfer recording, it can record it, without producing sticking, printing dregs, etc. also at the time of thermal recording, and is to offer the thermal recording medium which moreover does not produce blocking.

[Translation done.]

English Translation of JP2002-307825A

* NOTICES *

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MEANS TO SOLVE THE PROBLEM

As a result that the people of present invention studied zealously, polyolefin resin corpuscle is incorporated into an overcoat layer of thermal recording atmosphere, the ink acceptance characteristics that is good at the time of thermal ink transfer recording by what still and glass transformation temperature (Tg) incorporates acrylic resin of less than or equal to 20 degrees Celsius, urethane resin, higher than one kind of either of SBR latex into more than -60 degrees Celsius are had, it can be recorded without producing スティックング, print refuse at the time of thermal recording, thermal recording medium without, besides, producing blocking became invent.

[0010]

MODE FOR CARRYING OUT THE INVENTION

As for the thermal recording atmosphere of the present invention, it is provided color precursor of normal colorlessness or a pale color of electro-donicity more than at least one kind and the color precursor on support by what is provided with thermal recording layer containing developer of electron-accepting of higher than one kind making do coloring at heat time.

The only operative example that coloring does in red system color, yellow system color, blue system color, green system color, black system color as dye precursor used with the present invention is given, but is not limited to these.

[0011]

It is 3,3- screw (1-n- butyl -2 - methylindole -3 - yl) phthalide, 3,3- screw (1-n- butyl -2 - methylindole -3 - yl) tetrachloro phthalide, 3,3- screw (1-n- butyl indole -3 - yl) phthalide, 3,3- screw (1-n- pentyl -2 - methylindole -3 - yl) phthalide, 3,3- screw (1-n- hexyl -2 - methylindole -3 - yl) phthalide, 3,3- screw (1-n- octyl -2 - methylindole -3 - yl) phthalide, 3,3- bis (one - carbonyl -2 - methylindole -3 - yl) phthalide, 3,3- bis (one - ethyl -2 - methylindole -3 - yl) phthalide, 3,3- bis (one - propyl -2 - methylindole -3 - yl) phthalide, 3,3- bis (two methylindole -3 - yl) phthalide, Rhodamine B - anilino lactam, Rhodamine B - (o- chloroanilino) lactam, Rhodamine B - (p- nitroanilino) lactam, three - diethylamino -5 - carbonyl -7 - dibenzylamino full Oran, three - diethylamino -6 - carbonyl -7 - chlorofull Oran, three - diethylamino -6 - methoxy full Oran, three - diethyl a as red system dyeing charges precursor Mino -6 - carbonyl full Oran, three - diethylamino

-6 - carbonyl -7 - chloro-8 - benzil full Oran, three 6,7 - diethylamino - dimethyl full Oran, three 6,8 - diethylamino - dimethyl full Oran, three - diethylamino -7 - chlorofull Oran, three - diethylamino -7 - methoxy full Oran, three - diethylamino -7 - (N- acetyl -N- carbonyl) amino full Oran, three - diethylamino -7 - carbonyl full Oran, three - diethylamino -7 - carbonyl ethoxy full Oran, three - diethylamino -7-p- methylphenyl full Oran, three 7,8 - diethylamino - Ben Zopf Luo orchid, three - diethylamino benz [a] full Oran, three - diethylamino benz [c] full Oran, three - dimethylamino -7 - methoxy full Oran, three - dimethylamino -6 - carbonyl -7 - chlorofull Oran, three - dimethylamino -7 - carbonyl full Oran, three - dimethylamino -7 - chlorofull Oran, three - (N- ethyl -p- toluidino) -7 - carbonyl full Oran, three - (N- ethyl -N- isoamyl) amino -6 - carbonyl -7 - chlorofull Oran, three 7,8 - (N- ethyl -N- isoamyl) amino - Ben Zopf Luo orchid, three - (N- Ettie) Roux -N- isoamyl) amino -7 - carbonyl full Oran, three - (N- ethyl -N-n- octyl) amino -6 - carbonyl -7 - chlorofull Oran, three 7,8 - (N- ethyl -N-n- octyl) amino - Ben Zopf Luo run, three - (N- ethyl -N-n- octyl) amino -7 - carbonyl full Oran, three - (N- ethyl -N-n- octyl) amino -7 - chlorofull Oran, three 7,8 - (N- ethyl -N-4- methylphenyl) amino - Ben Zopf Luo orchid, three - (N- ethyl -N-4- methylphenyl) amino -7 - carbonyl full Oran, three 7,8 - (N- isopentyl -N- ethyl) amino - Ben Zopf Luo orchid, three 7,8 - (N- ethoxyethyl -N- ethyl) amino - Ben Zopf Luo orchid, three - (N- ethoxyethyl -N- ethyl) amino -7 - chlorofull Oran, 3-n- dibutyl amino -6 - carbonyl -7 - chlorofull Oran, 7,8- 3-n- dibutyl amino - Ben Zopf Luo orchid, 3-n- dibutyl amino -7 - chlorofull Oran, 3-n- dibutyl amino -7 - carbonyl full Oran, three 7,8 - diallyl amino - Ben Zopf Luo orchid, three - diallyl amino -7 - chlorofull Oran,

Three - di-n- butylamino -6 - carbonyl -7 - ブロモフルオラン, three - cyclohexyl amino -6 - chlorofull Oran, three - pyrrolidyl amino -7 - carbonyl full Oran, three - ethylamino -7 - carbonyl full Oran, three - diethylamino - benz [a] full Oran, 3-N- ethyl -N- isoamyl amino - benz [a] full Oran, 3-N- ethyl -N-p- methylphenyl amino -7 - carbonyl full Oran, three - dibutyl amino -6 - carbonyl -7 - ブロモフルオラン, 3,6- bis (diethylamino full Oran) - gamma - (four ' - nitro) anilino lactam.

[0012]

As yellow system dyeing charges precursor, it is 3,6- dimethoxy full Oran, three - cyclohexyl amino -6 - chloro full Oran, 2,6- diphenyl -4 - (four - dimethylaminophenyl) - pyridine, 2,2- screw (four two four - (- (- diethylaminophenyl) cinchona zoril) Oki ti phenyl) propane, four - chloro-N- (four four - (N- (- methylbenzyl) -N- methylamino) benzylidene) aniline, one - (two - quinoly) -2 - (three - methoxy -4 - doh decyloxy phenyl) ethene, one - (4-n- doh decyloxy -3 - methoxyphenyl) -2 - (two - quinoly) ethylene.

[0013]

For dyeing charges precursor pro-blue, three - (one - ethyl -2 - methylindole -3 - yl) -3 - (four - diethylaminophenyl) phthalide, three - (one - ethyl -2 - methylindole -3 - yl) -3 - (two - carbonyl -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl

-2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - methylamino phenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - ethylamino phenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dimethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dipropylamino phenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -) Four - dibutyl aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dipentyl aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dihexyl aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - methylindole -3 - yl) -3 - (two - ethoxy -4 - dihydroxy aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dichloro aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dibromo aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diallyl aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dihydroxy aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dimethoxy aminophenyl) -4 - アザフタリド, Three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethoxy aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dicyclohexyl aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dimethyl ethoxy aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethyl ethoxy aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethyl butoxy aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - ジメチルシクロヘキサミノフェニル) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - dimethoxy cyclohexyl aminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - pyrrolidyl aminophenyl) -4 - アザフタリド,

Three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (three - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (2,3- diethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (four - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (two - chloro-4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - roux -3 - yl) -3 - (three - chloro-4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl

-2 - carbonyl India - rous -3 - yl) -3 - (two - ブロモ -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (three - ブロモ -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - ethyl -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - propyl -4 - the) Ethylamino phenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (three - carbonyl -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - nitro -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - allyl -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - hydroxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - cyano -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - cyclohexyl ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - carbonyl ethoxy -4 - diethylaminophenyl) -4 - アザフタリド,

Three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - cyclohexyl ethyl -4 - diethylaminophenyl) -4 - アザフタリド, three - (two - ethyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - black loin doh - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - ブロモインド - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - ethyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - propyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - methoxy Indian - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - ethoxy India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド,

Three - (one - ethyl -2 - phenyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -7 - アザフタリド, three 4,7- - (one - ethyl -2 - carbonyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) - ジアザフタリド, three - (one 4,5,6,7- - ethyl - tetrachloro -2 - carbonyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -4 - nitro -2 - carbonyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -4 - methoxy -2 - carbonyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethyl -4 - methylamino -2 - carbonyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド,

Three - (one - ethyl -4 - carbonyl -2 - carbonyl India - rous -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (two - carbonyl India - rous -3 - yl)

-3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - chloro-2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ブロモ -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - carbonyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - carbonyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -7 - アザフタリド, three - (one - propyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - butyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド,

Three - (one - butyl -2 - India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -7 - アザフタリド, three - (one - pentyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - hexyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - hexyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -7 - アザフタリド, three - (one - octyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - octyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -7 - アザフタリド, three 4, 7- - (one - octyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) - ジアザフタリド, three - (one - nonyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド,

Three - (one - methoxy -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - ethoxy -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - phenyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -4 - アザフタリド, three - (one - pentyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -7 - アザフタリド, three - (one - heptyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -7 - アザフタリド, three - (one - nonyl -2 - carbonyl India - roux -3 - yl) -3 - (two - ethoxy -4 - diethylaminophenyl) -7 - アザフタリド, 3, 3- screw (p- dimethylaminophenyl) -6 - dimethylamino phthalide, three - (four - dimethylamino -2 - methylphenyl) -3 - (four - dimethylaminophenyl) -6 - dimethylamino phthalide,

Three - (one - ethyl -2 - methylindole -3 - yl) -3 - (four - diethylamino -2-n-hexyloxyphenyl) -4 - アザフタリド.

[0014]

For dyeing charges precursor pro-green, three - (N- ethyl -N-n- hexyl) amino -7 - anilino full Oran, three - (N- ethyl -N-p- tolyl) amino -7 - (N- phenyl -N- carbonyl) amino full Oran, three - (N- ethyl -N-n- propyl) amino -7 - dibenzylamino full Oran, three - (N- ethyl -N-n- propyl) amino -6 - chloro-7 - dibenzylamino full Oran, three - (N- ethyl -N-4- methylphenyl) amino -7 - (N- carbonyl -N- phenyl) amino full Oran, three - (N- ethyl -4

- methylphenyl) amino -7 - dibenzylamino full Oran, three - (N- ethyl -4 - methylphenyl) amino -6 - carbonyl -7 - dibenzylamino full Oran, three - (N- ethyl -4 - methylphenyl) amino -6 - carbonyl -7 - (N- carbonyl - benzil) amino full Oran, three - (N- carbonyl -N-n- hexyl) amino -7 - anilino full Oran, three - (N- propyl -N-n- hexyl) amino -7 - anilino full Oran, three - (N- ethoxy -N-n- hexyl) amino -7 - anilino full Oran, three - (N-n- pentyl -N- allyl) amino -6 - carbonyl -7 - anilino full Oran,

Three - (N-n- pentyl -N- allyl) amino -7 - anilino full Oran, 3-n- dibutyl amino -6 - chloro-7 - (two - chloroanilino) full Oran, 3-n- dibutyl amino -6 - carbonyl -7 - (two - chloroanilino) full Oran, 3-n- dibutyl amino -6 - carbonyl -7 - (two - fluoro anilino) full Oran, 3-n- dibutyl amino -7 - (two - chloroanilino) full Oran, 3-n- dibutyl amino -7 - (two - chlorobenzyl anilino) full Oran, 3,3- screw (four - diethylamino -2 - ethoxyphenyl) -4 - アザフタリド, 3,6- bis (dimethylamino) fluorene -9 - spiro -3 ' - (six ' - dimethylamino) phthalide, three - diethylamino -6 - carbonyl -7 - benzylamino - full Oran, three - diethylamino -6 - carbonyl -7 - dibenzylamino full Oran, three - diethylamino -6 - carbonyl -7-n- octyl amino full Oran, three - diethylamino -6 - carbonyl -7 - (N- cyclohexyl -N- benzylamino) full Oran,

Three - diethylamino -6 - carbonyl -7 - (two - chloroanilino) full Oran, three - diethylamino -6 - carbonyl -7 - (two - trifluoromethyl anilino) full Oran, three - diethylamino -6 - carbonyl -7 - (three - trifluoromethyl anilino) full Oran, three - diethylamino -6 - carbonyl -7 - (two - ethoxy anilino) full Oran, three - diethylamino -6 - carbonyl -7 - (four - ethoxy anilino) full Oran, three - diethylamino -6 - chloro-7 - (two - chloroanilino) full Oran, three - diethylamino -6 - chloro-7 - dibenzylamino full Oran, three - diethylamino -6 - chloro-7 - anilino full Oran, three - diethylamino -6 - ethyl ethoxy -7 - anilino full Oran, three - diethylamino -7 - anilino full Oran, three - diethylamino -7 - methylanilino full Oran, three - diethylamino -7 - dibenzylamino full Oran, three - diethylamino -7-n- octyl amino full Oran, three - diethylamino -7-p- chloro anilino full Oran, three - diethylamino -7-p- methylphenyl anilino full Oran,

Three - diethylamino -7 - (N- cyclohexyl -N- benzylamino) full Oran, three - diethylamino -7 - (two - chloroanilino) full Oran, three - diethylamino -7 - (three - trifluoro anilino) full Oran, three - diethylamino -7 - (two - trifluoromethyl anilino) full Oran, three - diethylamino -7 - (two - ethoxy anilino) full Oran, three - diethylamino -7 - (four - ethoxy anilino) full Oran, three - diethylamino -7 - (two - chlorobenzyl anilino) full Oran, three - dimethylamino -6 - chloro-7 - dibenzylamino full Oran, three - dimethylamino -6 - carbonyl -7-n- octyl amino full Oran, three - dimethylamino -7 - dibenzylamino full Oran, three - dimethylamino -7-n- octyl amino full Oran, three - dibutyl amino -7 - (two - fluoro anilino) full Oran, three - □-6- p- (p- anilino anilino) anilino carbonyl -7 - chlorofull Oran, three - anilino -7 - dibenzylamino full Oran, three - anilino -6 - carbonyl -7 - dibenzylamino full Oran]

Three - pyrrolidino -7 - dibenzylamino full Oran, three - pyrrolidino - (seven - cyclohexyl

anilino) full Oran, three - dibenzylamino -6 - carbonyl -7 - dibenzylamino full Oran, three - dibenzylamino -7 - dibenzylamino full Oran, three - dibenzylamino -7 - (two - chloroanilino) full Oran.

[0015]

For dyeing charges precursor pro-guilt, three - dibutyl amino -6 - carbonyl -7 - anilino full Oran, three - dibutyl amino -6 - carbonyl -7 - phenylamino full Oran, three - dibutyl amino -7 - (two - chloroanilino) full Oran, three - dibutyl amino -7 - (o- chlorophenyl) amino full Oran, three - diethylamino -6 - carbonyl -7 - anilino full Oran, three - diethylamino -6 - carbonyl -7 - phenylamino full Oran, three - diethylamino -6 - carbonyl -7 - キシリジノフルオラン, three - diethylamino -7 - (two - chloroanilino) full Oran, three - diethylamino -7 - (o- chlorophenyl) amino full Oran, three - diethylamino -7 - (o- chlorophenyl) amino - full Oran, three - diethylamino -7 - (two - carbomethoxy - phenylamino) full Oran, three - (N- cyclohexyl -N- carbonyl) amino -6 - carbonyl -7 - anilino full Oran, three - (N- cyclohexyl -N- carbonyl) amino -6 - carbonyl -7 - phenylamino full Oran, three - (N- cyclopentyl -N- ethyl) amino -6 - carbonyl -7 - phenylamino full Oran,

There are three - (N- isoamyl -N- ethyl) amino -6 - carbonyl -7 - anilino full Oran, three - (N- ethyl -p- toluidino) -6 - carbonyl -7 - anilino full Oran, three - (N- ethyl -p- toluidino) -6 - carbonyl -7 - (p- toluidino) full Oran, three - (N- ethyl -N- isoamyl) amino -6 - carbonyl -7 - phenylamino full Oran, three - (N- carbonyl -N- tetrahydro furfuryl) amino -6 - carbonyl -7 - phenylamino full Oran, three - (N- ethyl -N- tetrahydro furfuryl) amino -6 - carbonyl -7 - phenylamino full Oran, three - pyrrolidino -6 - carbonyl -7 - phenylamino full Oran, three - pyrrolidino -6 - carbonyl -7 - p- butylphenyl amino full Oran, three - piperidino -6 - carbonyl -7 - phenylamino full Oran, two - phenylamino -3 - carbonyl -6 - (N- ethyl -N- p- toluy) amino - full Oran.

[0016]

Thermal recording atmosphere of the present invention can perform color precursor of electro-donicity of normal colorlessness - a pale color and the color precursor by what is provided with the thermal recording layer which is based on developer of electron-accepting making do coloring at heat time on support, but this thermal recording layer can use monochrome thermal recording layer or multicolor thermal recording layer by a wish.

It can come true by manner to describe below in the event of multicolor thermal recording in particular.

By manner to provide with the thermal recording layer more than two levels, stratification does color precursor doing coloring in different color tone each other (1) in high temperature coloring layer and cryogenic temperature coloring layer, there is manner (Japanese Patent Laid-Open No. 54-097048 bulletin) to get color mixture with cryogenic temperature color tone and high temperature color tone at the time of a high temperature print to continue for a cryogenic temperature print.

Because, as for this manner, lower the high temperature color development layer, if it is low sensibility, and this will be done in high sensitivity, color isolation is still insufficient without can avoid color mixture of high temperature color at the time of a cryogenic temperature color print.

Discharge agent layer is gone through in high temperature coloring layer and cryogenic temperature coloring layer, and stratification does color precursor doing color development in different hue in each other to improve this color separation (2), while, at the time of a high temperature print to continue for a cryogenic temperature print, discharge does cryogenic temperature coloring layer, manner (Japanese Patent Laid-Open No. 55-139470 bulletin, Japanese Patent Laid-Open No. 57-178791 bulletin) of discharge pattern to print is suggested.

This formula is for a cryostatic temperature color to be able to leave discharge in high temperature color development, and color isolation is good at all, but, as for there being discharge agent in thermal recording layer, uneasiness stays in keeping quality of pictorial image at the time of long term storage, there is the shortcoming that production cost is high.

[0017]

On the other hand,

The thermal recording layer is single-layered, and plural color precursor doing coloring in different color tone in each other for manner to get preferable multicolor log of color separation (3) is contained in equivalence layer, there is manner (Japanese Patent Laid-Open No. 8-282115 bulletin), at a minimum, to contain one kind in microcapsule of the color precursor.

Separation-colored in dye precursor being isolated with capsule membrane as for this manner mutually is preferable, but because oiliness liquid is contained in microcapsule, capsule is destroyed by pressure and rubbing of a handling, and skin coloration occurs, there is shortcoming in keeping quality of also pictorial image.

[0018]

Furthermore,

(4) High temperature developed color precursor is done with compound corpuscle in poly urea and at least one kind of high molecular material preferred to polyurethane, solid particle of cryogenic temperature color precursor and manner (Japanese Patent Laid-Open No. 9-142025 bulletin) to use together are suggested.

In this approach,

A large quantity of poly urea or polyurethane will be incorporated to completely jacket dye precursor, color isolation is preferable, but there is a difficulty of coloring sensibility shortage.

Furthermore,

(5) There is manner (Japanese Patent Laid-Open No. 11-301118 bulletin), at a minimum, to

cover higher than one kind in the coloring control layer which polymerized in chemical agent having unsaturated carbon bond of color precursor of more than two kinds doing color development in a different hue.

Dye precursor corpuscle is solid, and this manner is covered up by thin high polymer molecule coating (the color development accommodation layer), by control of film thickness and use material of this coloring control layer, coloring sensibility is regulated, and color isolation with cryogenic temperature color and high temperature color can be controlled, but, as for the coloring sensibility itself, only minute with coloring control layer becomes low sensibility.

For reasons of the separation-colored for manner to realize multicolor thermal recording in the present invention, the sensibility, the keeping quality, manner of the (5) is particularly desirable.

[0019]

Next,

For example, for developer of the dye precursor and the electron-accepting which it is responded, and do color development, a thing as shown in follows is given.

[0020]

4,4' - dihydroxy diphenylsulphon, 2,4' - dihydroxy diphenylsulphon, four - hydroxy -4' - isopropoxy diphenylsulphon, four - hydroxy -4' - benzyloxy diphenylsulphon, four - hydroxy -4' - propoxy diphenylsulphon, screw (three - allyl -4 - hydroxyphenyl) sulfone, 3,4- dihydroxy -4' - carbonyl diphenylsulphon, four - hydroxy -4' - benzenesulphonyl Oki ti diphenylsulphon, 2,4- bis (phenylsulfonyl) phenol, p- phenylphenol, p- hydroxyacetophenone, 1,1- bis (p- hydroxyphenyl) propane, 1,1- bis (p- hydroxyphenyl) pentane, 1,1- bis (p- hydroxyphenyl) hexane, 1,1- bis (p- hydroxyphenyl) cyclohexane, 2,2- bis (p- hydroxyphenyl) propane, 2,2- bis (p- hydroxyphenyl) hexane, 1,1- bis (p- hydroxyphenyl) -2 - ethylhexane, 2,2- bis (three - chloro-4 - hydroxyphenyl) propane, 1,1- bis (p- hydroxyphenyl) -1 - phenylethane,

1,3- two di- [- (p- hydroxyphenyl) -2 - propyl] benzene, 1,3- two di- [- (3,4- dihydroxyphenyl) -2 - propyl] benzene, 1,4- two di- [- (p- hydroxyphenyl) -2 - propyl] benzene, 4,4' - hydroxy diphenyl ether, 3,3 4,4' - dichloro - ' - hydroxy diphenyl sulfide, 2,2- screw (four - hydroxyphenyl) methyl acetate, 2,2- screw (four - hydroxyphenyl) butyl acetate, 4,4' - チオビス (2-tert- butyl -5- methylphenol), four - hydroxy dimethyl phthalate, four - hydroxy benzyl benzoate, four - hydroxybenzonate methyl, gallic acid benzil, gallic acid stearyl, N, N' - diphenylthiourea, 4,4' - bis (three four - (methylphenyl sulfonyl) ureide) diphenyl-methane, N- (four - methylphenyl sulfonyl) -N' - phenylurea, salicylanilide, five - chlorosalicylanilide, salicylic acid, 3,5- di- Tasha Reeve till salicylic acid, 3,5- di- α - methylbenzyl salicylic acid, four - [2' - (four - methoxyphenoxy) ethyl Oki ti] salicylic acid,

Three - (octyloxy carbonylamino) salicylic acid or metallic salt of these salicylic acid

derivatives, N- (four - hydroxyphenyl) -p- toluene sulfonamide, N- (four - hydroxyphenyl) benzene sulfonamide, N- (four - hydroxyphenyl) -1 - naphthalenesulfonamide, N- (four - hydroxyphenyl) -2 - naphthalenesulfonamide, N- (four - hydroxy naphthyl) -p- toluene sulfonamide, N- (four - hydroxy naphthyl) benzene sulfonamide, N- (four - hydroxy naphthyl) -1 - naphthalenesulfonamide, N- (four - hydroxy naphthyl) -2 - naphthalenesulfonamide, N- (three - hydroxyphenyl) -p- toluene sulfonamide, N- (three - hydroxyphenyl) benzene sulfonamide, N- (three - hydroxyphenyl) -1 - naphthalenesulfonamide, N- (three - hydroxyphenyl) -2 - naphthalenesulfonamide are given.

Or these mix more than two kinds alone, and 100-700 are desirable, and it is used at the rate of 150-400 part by weight as against 100 total weight part by weight of dye precursor.

[0021]

Thermal recording atmosphere of the present invention can incorporate heat fusibility matter into the thermal recording layer if necessary to improve thermal responsiveness.

For this case,

A thing having a melt point of 60 degrees Celsius - 180 degrees Celsius is preferable and a thing having a melt point of 80 degrees Celsius - 140 degrees Celsius in particular depends and is desirable.

[0022]

For heat fusibility matter (sensitizing agent) to improve such a thermal responsiveness, N- hydroxymethyl stearic acid amide, stearic acid amide, Barumi Japanese spaniel acid amide, oleic amide, ethylenebis stearic acid amide, 12-hydroxyoleic acid amide, paraffin wax, microcrystallin wax, polyethylene wax, rice wax, waxes such as carnauba wax, naphthols such as two - benzyloxy naphthalene, p- benzil biphenyl, four - allyloxy biphenyl, biphenyls such as m- terphenyl, 1,2- bis (three - methylphenoxy) ethane, 2,2' - bis (four - methoxyphenoxy) diethyl ether, poly ether compound such as bis (four - methoxyphenyl) ether, diphenyl carbonate, oxalic acid dibenzyl, carbonic acid such as oxalic acid di(p-chlorobenzyl) ester or oxalic acid diester derivative is given, but the present invention is not limited to this.

[0023]

Or these sensitizing agent mixes more than two kinds alone, and it can be used.

In addition,

When it is usually used as the thermal recording layer which is based on developer of electro-donicity color precursor and electron-accepting of colorlessness - a pale color to get enough thermal responsiveness, preferred, even more particularly, what 30-350 % by weight is used as depend, and what 20-400 % by weight is used as for the electro-donicity color precursor is desirable.

[0024]

The thermal recording layer in the present invention is formed by providing thermal recording component over support.

Manner to provide thermal recording component over support is not limited in particular, but manner to print manner to apply coating fluid including thermal recording constituent, ink including thermal recording constituent can be used.

In addition,

A binder can be incorporated into the thermal recording layer if necessary.

A binder to incorporate into the thermal recording layer is not limited in particular, but particularly preferred, the thing that there is little effect to give chromogenic property of thermal recording component is used.

[0025]

As an operative example of a binder to apply to the thermal recording layer in the present invention and an overcoat layer, it is aquaresin such as starch, hydroxyethyl cellulose, methyl cellulose, ethyl cellulose, carboxymethyl-cellulose, gelatine, casein, polyvinyl alcohol, degeneration polyvinyl alcohol, polyacrylic acid, polymethyl methacrylate.

Polyacrylate, polymethacrylic acid ester, polysodium acrylate, polyethylene terephthalate, polybutylene terephthalate, chlorinated polyether, allyl resin, furan resin, ketone resin, oxybenzoyl polyester, polyacetal, polyetheretherketone, polyethersulfone, polyimide, polyamide, polyamide-imide, poly amino bismaleimide, polymethylpentene, polyphenylene oxide, polyphenylene sulfide, polyphenylene sulfone, polysulfone, polyarylate, poly allyl sulfone, polybutadiene, polycarbonate, polyethylene, polypropylene, polystyrene, polyvinylchloride, polyvinylidene chloride, poly, polyurethane, phenol resin, urea resin, melamine resin, melamine formalin resin, a benzoguanamine resin, BT resin, alkyd resin, amino resin, epoxide resin, unsaturated polyester resin, styrene / butadiene copolymer, acrylonitrile / butadiene copolymer, methyl acrylate / butadiene copolymer, ethylene / acetic acid vinyl copolymer, acrylic acid amide / acrylate copolymer,

Water dispersion resin of acrylic acid amide / acrylate / methacrylic acid 3 yuan copolymer, alkali salt of styrene / maleic anhydride copolymer, alkali salt of ethylene / maleic anhydride copolymer or ammonium salts is given, or it is mixed more than two kinds alone, and these can be used.

[0026]

Copolymer with various principal monomer can be used as polyolefin resin corpuscle used for an overcoat layer in the present invention only as well as independent copolymer of single olefin.

[0027]

Polyethylene resin, polypropylene resin, a polybutylene resin are nominated for copolymer alone, but, above all, polyethylene resin, polypropylene resin are preferable, and a particularly preferred thing is low-density polyethylene resin.

[0028]

Among copolymer with various principal monomer, ethylene - polar character principal

monomer copolymer is given as a preferred person.

Above all, ethylene - (meta) methyl acrylate copolymer, ethylene - (meta) ethyl acrylate copolymer, ethylene - (meta) acrylic acid propyl copolymer, ethylene - (meta) butyl acrylate copolymer, ethylene - (meta) acrylic acid hexyl copolymer, ethylene - (meta) acrylic acid -2 - hydroxyethyl copolymer, ethylene - (meta) acrylic acid -2 - hydroxypropyl copolymer, ethylene - (meta) acrylate copolymer such as ethylene - (meta) glycidyl acrylate copolymer, ethylene - (meta) acrylic acid copolymer, ethylene - maleic acid copolymer, ethylene - fumaric acid copolymer, ethylene - ethylenic unsaturation acid copolymer such as ethylene - crotonic acid copolymerization, ethylene - acetic acid vinyl copolymer, ethylene - propionic acid vinyl copolymer, ethylene - butanoic acid vinyl copolymer, ethylene - vinylester copolymer such as ethylene - vinyl stearate copolymer or ethylene-styrene copolymer depends and is desirable.

More preferably, it is ethylene - vinylester copolymer, ethylene - (meta) acrylate copolymer, and a particularly preferred thing is ethylene - vinyl acetate copolymer.

Molecular weight of ethylene - polar character principal monomer copolymer should be the dimension which can form swabbing, dried back coating in base substance.

It is as for weight ratio 95/5 with ethylene and polar character principal monomer - 50/50.

[0029]

When when average particle diameter of polyolefin resin corpuscle to apply to an overcoat layer in the present invention became less than $1\mu\text{m}$, thermal recording was performed, スティッキング is easy to be waked up, when when it was than $20\mu\text{m}$, average particle diameter performed thermal ink transfer recording, print barrier such as white foolishness is easy to become wake up so that adhesion with ink ribbon falls.

Thus,

1 - $20\mu\text{m}$ are preferable, and preferably average particle diameter of polyolefin resin to apply to the present invention is 2 - $15\mu\text{m}$, and a particularly preferred thing is 3 - $10\mu\text{m}$.

[0030]

When combination quantity of polyolefin resin corpuscle to apply to an overcoat layer in the present invention performed thermal recording so that the polyolefin resin corpuscle which there was in the vicinity of coating surface decreased when it was in lower than five % by weight at weight ratio, スティッキング is easy to become wake up.

On the other hand,

When compounding ratio 90 of polyolefin resin corpuscle becomes larger than % by weight, binding capacity with a binder is weak, and falling off of corpuscle is easy to become produce, powdery oxidation coatings, falling off of hot printing ink are easy to become wake up.

Thus,

Preferred, as for quantity of combination 5 of polyolefin resin corpuscle to apply to an

overcoat layer in the present invention - 90 % by weight depends, and preferably it is 10 - 80 % by weight, and a particularly preferred thing is 15 - 70 % by weight.

[0031]

In addition,

When when amount of coating of an overcoat layer increased than 3g/m² in solid content, thermal recording was performed, depression of coloring sensibility, depression of color optical density are caused so that heat transfer to feeling fever color development layer falls.

Thus,

Less than 3g/m² are preferable in solid content, and preferably amount of coating of an overcoat layer in the present invention is lower than 2.5g/m², and a particularly preferred thing is lower than 1.5g/m².

[0032]

Marketed various kinds of resin can be used as acrylic resin used for an overcoat layer in the present invention, urethane resin, SBR latex.

[0033]

For acrylic resin used for an overcoat layer in the present invention, the thing that inter-polymerization did a various kinds of acryl system monomeric substance or the thing that copolymerization did acryl system monomer and vinyl monomer can be used.

In a specific example, the polymer set series made in Arakawa Chemical Industrial, the Nak lyric poem series of a product made in Japanese N S she, the Rika bond series of a product made in Chuo Rika Kogyo, モビニールシリーズ of a product made in Hoechst synthesis, the product made in Mitsui chemistry Bonn Ron series, サイビノールシリーズ of a product made in Saiten Chemical Industry, the Bonn coat series of a product made in Dainippon Ink & Chemicals are given.

[0034]

For urethane resin used for an overcoat layer in the present invention, the thing which copolymerization was able to put low molecular weight polyol having a polyisocyanate compound and polyetherpolyol, high molecular weight polyols chemical agent such as polyester polyol or carboxyl group or sulfonate group in can be used.

For these operative examples, the super flextime series made in Dai-ichi Kogyo Seiyaku, the Erastus Ron series, the bond KU series of a product made in Konishi, the Bonn Dick series of a product made in Dainippon Ink & Chemicals, the hide orchid HW series, the hide orchid AP series are given.

[0035]

For SBR latex used for an overcoat layer in the present invention, the thing which made styrene and butadiene emulsion polymerize can be used.

For these operative examples, the Lux Taha series made in DL series made in Asahi Chemical Industry, L series, ニポールシリーズ made in Nippon Zeon, Dainippon Ink & Chemicals is

given.

[0036]

It is more than -60 degrees Celsius and lower than 20 degrees Celsius, and preferably lower than 15 degrees Celsius depend more than -40 degrees Celsius, and preferably acrylic resin used for an overcoat layer in the present invention, urethane resin, at least one kind of glass transformation temperature (Tg) of SBR latex are lower than 10 degrees Celsius more than -20 degrees Celsius.

When when Tg went low than -60 degrees Celsius, blocking was easy to become cause, and there was not, and feeling heat was printed, ステッキング, print refuse are easy to become cause.

On the other hand,

When when Tg rose than 20 degrees Celsius, a hot printing print was performed, binding capacity with ink component deteriorates, and reproducibility of dot becomes bad.

[0037]

Purpose is accepted, and, for support used for the present invention, as for the plastics films such as paper, various bonded mats, a fabric cloth, polyethylene terephthalate or polypropylene, the polyethylene, the paper laminate, the synthetic paper, the metallic foil such as aluminium, the glass that laminate did synthetic resin such as polypropylene or the composite sheets which put these together can be used optionally, but is not limited to these.

These are opaque, and transperence, either which are semitransparent are preferable.

A white pigment and existence dyeing pigment and air void may be incorporated into the whole support or surface to make the skin look like a particular color of white color others.

[0038]

Lamination of the thermal recording layer in the present invention can provide with interlayer to resemble the thermal recording layer during during support or thermal recording layer and an overcoat layer if necessary.

In addition,

When that is all for two levels of thermal recording layer, intermediate layer can be provided with between the different thermal recording stratum.

In these cases, as for two levels of intermediate layer - plural sheaf more than three levels may be comprised.

Furthermore, face of face and the opposite side which the thermal recording layer of support is installed in can be provided with various kinds of recording layer such as Karl prevention, back coat layer aimed for static elimination or IJ recording layer aimed for a magnetic recording layer, ink jet printing aimed for magnetic recording.

[0039]

Each aqueous dispersion and binder - which the thermal recording layer in the present invention crushes color development component slightly, and is provided are mixed, because

swabbing dries on support, it can be got.

For this case,

Plural color development component is incorporated into plural sheaf by a wish and are preferable as a multilayer construction, but what is incorporated into the same layer is desirable.

[0040]

Photothermal conversion material can be incorporated by the end of arbitrary layer in thermal recording atmosphere and support to perform a print with the use of a laser beam in thermal recording atmosphere of the present invention.

[0041]

In arbitrary sheaf of thermal recording atmosphere of the present invention, as necessary, such as diatom soil, purified talc, porcelain clay, baking kaolin, calcium carbonate, magnesium carbonate, titania, zinc oxide, silicon oxide, aluminium hydroxide, urea - formalin resin, inorganic, and, in addition, even more particularly, organic pigment, dispersing agent such as dioctyl sulfo sodium succinate can incorporate surface active agent and fluorescent dye with waxes such as zinc stearate, higher fatty acid metal salt such as calcium stearate, paraffin, oxidation paraffin, polyethylene, oxidation polyethylene, stearic acid amide, castor wax.

[0042]

In addition,

Oxidation inhibitor, UV absorber can be added for the purpose of improving light resistance.

For oxidation inhibitor, hindered amine system oxidation inhibitor, hindered phenolic antioxidant and sulfide system oxidation inhibitor are given.

In addition,

For UV absorber, benzotriazole system UV absorber, salicyl acid system UV absorber, organic system UV absorber such as benzophenone system UV absorber and inorganic system UV absorber such as zinc oxide, titania, cerium oxide are given.

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

EXAMPLE

[Example] An example explains this invention in more detail below. In addition, the following sections are the weight sections and % expresses weight %.

[0044] The ball mill ground the 3-dibutylamino-6-methyl-7-anilino-fluoran 3 section which is the preparation black developed color precursor of the coating liquid for example 1 (A1) multicolor heat-sensitive recording layer (elevated-temperature coloring layer) formation with the polyvinyl alcohol water-solution 7 section 2%, and the color precursor dispersion-liquid 10 section with a volume mean particle diameter of 1 micrometer was obtained. Subsequently, the ball mill ground the 2 and 2'-screw {4-(4-hydroxyphenyl sulfonyl) phenoxy} diethylether 5 section which is a developer with the polyvinyl alcohol water-solution 10 section 2%, and the developer dispersion-liquid 15 section with a volume mean particle diameter of 1 micrometer was obtained. The two above-mentioned sorts of dispersion liquid were mixed, and the coating liquid for multicolor heat-sensitive recording layer formation (elevated-temperature coloring layer) was prepared.

[0045] (A2) The ball mill ground the 3-diethylamino-7-chloro-fluoran 3 section which is the preparation red developed color precursor of the coating liquid for multicolor heat-sensitive recording layer (low-temperature coloring layer) formation with the polyvinyl alcohol water-solution 7 section 2%, and the color precursor dispersion-liquid 10 section with a volume mean particle diameter of 1 micrometer was obtained. Subsequently, the ball mill ground the N-(4-hydroxyphenyl)-p-toluenesulfonamide 5 section which is the developer of electronic receptiveness with the polyvinyl alcohol water-solution 10 section 2%, and the developer dispersion-liquid 15 section with a volume mean particle diameter of 1 micrometer was obtained. Moreover, the ball mill ground the oxalic acid G p-methylbenzyl 5 section with the polyvinyl alcohol water-solution 10 section 2%, and the oxalic acid G p-methylbenzyl dispersion-liquid 15 section of 1 micrometer of volume mean diameters was obtained. Furthermore, the homogenizer ground the calcium-carbonate 3 section with the hexametaphosphoric acid sodium water-solution 7 section 2%, and the calcium-carbonate dispersion-liquid 10 section with a volume mean particle diameter of 1 micrometer was obtained. The four above-mentioned sorts of dispersion liquid were mixed, and the coating liquid for multicolor heat-sensitive recording layer formation (low-temperature coloring layer) was prepared.

[0046] (B) it becomes 10 g/m² to the basis weight of 50g/the paper of fine quality of m² as an amount of solid content smear about the coating liquid which consists of combination of the production baking kaolin 100 section of a sensible-heat coating form, the 50% styrene-butadiene system latex water dispersion 24 section, and the water 200 section -- as -- coating -- it dried and the sensible-heat layer coating form was produced.

[0047] (C1) The calcium-carbonate dispersion-liquid 10 section which grinds the 40% acrylic emulsion (SAIDEN CHEMICAL INDUSTRY make: SAIBI Norian EK-1005, Tg:-4 degree C) 45 of preparation section of the coating liquid for overcoat stratification, the 40% low consistency polyolefine dispersion-liquid (Mitsui Chemicals make: CHEMIPEARL M200, mean particle diameter of 6 micrometers) 45 section, and the calcium-carbonate 3 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 7 section 2%, and is obtained was mixed, and the coating liquid for overcoat stratification was prepared.

[0048] (D1) the amount of solid content coating is set to 3g/m² in the sensible-heat coating

form produced by production (B) of a multicolor heat-sensitive recording layer in the coating liquid for multicolor heat-sensitive recording layer (elevated-temperature coloring layer) formation prepared by (A1) -- as -- coating -- it dried. Furthermore, calender processing of the coating liquid for multicolor heat-sensitive recording layer (low-temperature coloring layer) formation prepared by (A2) on this was carried out so that the amount of solid content coating might become 2 g/m², and the Beck smoothness of a coating side might become 400 - 500 seconds, after drying, coating, and the multicolor heat-sensitive recording layer was prepared. [0049] On the multicolor heat-sensitive recording layer prepared by (D1), calender processing of the coating liquid for overcoat stratification prepared by (C1) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0050] The ball mill ground the 3-diethylamino-6-methyl-7-(3-trifluoromethyl ANIRINO) fluoran 5 section which is the electron-donative color precursor of preparation black coloring of the coating liquid for example 2 (A3) multicolor heat-sensitive recording layer formation with the polyvinyl alcohol water-solution 90 section 2.5%, and color precursor dispersion liquid with a volume mean particle diameter of 1 micrometer were obtained. Subsequently, these dispersion liquid were moved to the polymerization container, and the temperature up was carried out to 70 degrees C, adding and stirring the methyl-methacrylate 2 section and the ethylene glycol dimethacrylate 0.5 section. The potassium persulfate water-solution 2.5 section is added to this 2.5% which is a polymerization initiator, and it was made to react for 8 hours, continuing stirring. Subsequently, this was cooled to the room temperature and the dispersion-liquid 100 section of an electron-donative color precursor particle which prepared the coloring accommodation layer in the front face was obtained. Moreover, the ball mill ground the 3-diethylamino-7-chlorofluoran 3 section which is the color precursor of red coloring with the polyvinyl alcohol water-solution 7 section 2%, and the color precursor dispersion-liquid 10 section with a volume mean particle diameter of 1 micrometer was obtained. Subsequently, the ball mill ground the 2 and 2-screw (4-hydroxyphenyl) propane 6 section which is the developer of electronic receptiveness with the polyvinyl alcohol water-solution 14 section 2%, and the electronic receptiveness developer dispersion-liquid 20 section with a volume mean particle diameter of 1 micrometer was obtained. Moreover, the ball mill ground the 2-benzyloxy naphthalene 6 section with the polyvinyl alcohol water-solution 14 section 2% as a sensitizer, and the 2-benzyloxy naphthalene dispersion-liquid 20 section of 1 micrometer of volume mean diameters was obtained. Furthermore, the homogenizer ground the calcium-carbonate 5 section with the hexametaphosphoric acid sodium water-solution 10 section 2%, and the calcium-carbonate dispersion-liquid 15 section with a volume mean particle diameter of 1 micrometer was obtained. The five above-mentioned sorts of dispersion liquid were mixed, and the coating liquid for multicolor heat-sensitive recording layer formation was prepared.

[0051] (C2) The calcium-carbonate dispersion-liquid 10 section which grinds the 44% acrylic resin (SAIDEN CHEMICAL INDUSTRY make: EC-83, Tg:19 degree C) 45 of preparation section of the coating liquid for overcoat stratification, the 40% vinyl acetate system copolymerization polyolefine dispersion-liquid (Mitsui Chemicals make: CHEMPEARL V300, mean particle diameter of 8 micrometers) 45 section, and the calcium-carbonate 3 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 7 section 2%, and is obtained was mixed, and the coating liquid for overcoat stratification was prepared.

[0052] (D2) On the sensible-heat coating form produced by production (B) of a multicolor heat-sensitive recording layer, calender processing of the coating liquid for multicolor heat-sensitive recording layer formation prepared by (A3) was carried out so that the amount of solid content coating might serve as 5 g/m², and the Beck smoothness of a coating side might become 400 - 500 seconds, after drying, coating, and the multicolor heat-sensitive recording layer was prepared.

[0053] On the multicolor heat-sensitive recording layer prepared by (D2), calender processing of the coating liquid for overcoat stratification prepared by (C2) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side

might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0054] The ball mill ground the 3-dibutylamino-6-methyl-7-anilino-fluoran 3 section which is the preparation black developed color precursor of the coating liquid for example 3 (A4) monochrome heat-sensitive recording layer formation with the polyvinyl alcohol water-solution 7 section 2%, and the color precursor dispersion-liquid 10 section with a volume mean particle diameter of 1 micrometer was obtained. Subsequently, the ball mill ground the 2 and 2'-screw {4-(4-hydroxyphenyl sulfonyl) phenoxy} diethylether 5 section which is a developer with the polyvinyl alcohol water-solution 10 section 2%, and the developer dispersion-liquid 15 section with a volume mean particle diameter of 1 micrometer was obtained. The two above-mentioned sorts of dispersion liquid were mixed, and the coating liquid for monochrome heat-sensitive recording layer formation was prepared.

[0055] (D3) On the sensible-heat coating form produced by production (B) of a monochrome heat-sensitive recording layer, calender processing of the coating liquid for monochrome heat-sensitive recording layer formation prepared by (A4) was carried out so that the amount of solid content coating might serve as 5 g/m², and the Beck smoothness of a coating side might become 400 - 500 seconds, after drying, coating, and the monochrome heat-sensitive recording layer was prepared.

[0056] (C3) The dispersion-liquid 10 section which grinds the 30% urethane resin (Dai-Ichi Kogyo Seiyaku make: super FREX 200, Tg:-40 degree C) 60 of preparation section of the coating liquid for overcoat stratification, and the low-density-polyethylene resin particle (Sumitomo Seika Chemicals make: flow bead LE 1080, mean particle diameter of 6 micrometers) 30 section and the calcium-carbonate 3 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 7 section 2%, and is obtained was mixed, and the coating liquid for overcoats was prepared.

[0057] On the monochrome heat-sensitive recording layer prepared by (D3), calender processing of the coating liquid for overcoat stratification prepared by (C3) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0058] The calcium-carbonate dispersion-liquid 10 section which grinds the 35% urethane resin (Dai-Ichi Kogyo Seiyaku make: super FREX 700, Tg:6 degree C) 45 of preparation section of the coating liquid for example 4 (C4) overcoat stratification, the 40% low consistency polyolefine dispersion-liquid (Mitsui Chemicals make: CHEMIPPEARL M200, mean particle diameter of 6 micrometers) 45 section, and the calcium-carbonate 3 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 7 section 2%, and is obtained was mixed, and the coating liquid for overcoat stratification was prepared.

[0059] Calender processing of the coating liquid for overcoat stratification prepared by (C4) on the multicolor heat-sensitive recording layer prepared by (D1) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0060] The calcium-carbonate dispersion-liquid 10 section which grinds the 48% SBR latex (Nippon Zeon make: NIPORULX432A, Tg:-55 degree C) 45 of preparation section of the coating liquid for example 5 (C5) overcoat stratification, the 40% vinyl acetate system copolymerization polyolefine dispersion-liquid (Mitsui Chemicals make: CHEMIPPEARL M200, mean particle diameter of 6 micrometers) 45 section, and the calcium-carbonate 3 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 7 section 2%, and is obtained was mixed, and the coating liquid for overcoat stratification was prepared.

[0061] On the multicolor heat-sensitive recording layer prepared by (D1), calender processing of the coating liquid for overcoat stratification prepared by (C5) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0062] The calcium-carbonate dispersion-liquid 10 section which grinds the 49% SBR latex (Nippon Zeon make: NIPORU LX430, Tg:12 degree C) 45 of preparation section of the coating liquid for example 6 (C6) overcoat stratification, the 40% low consistency polyolefine dispersion-liquid (Mitsui Chemicals make: CHEMIPEARL M200, mean particle diameter of 6 micrometers) 45 section, and the calcium-carbonate 3 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 7 section 2%, and is obtained was mixed, and the coating liquid for overcoat stratification was prepared.

[0063] On the multicolor heat-sensitive recording layer prepared by (D1), calender processing of the coating liquid for overcoat stratification prepared by (C6) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0064] The homogenizer ground the 10% polyvinyl alcohol water-solution 20 of preparation section of the coating liquid for example of comparison 1 (C7) overcoat stratification, the glyoxal denaturation object 2 section of polyacrylic acid, the calcium-carbonate 15 section, and the water 60 section, and the coating liquid for overcoat stratification for thermographic recording papers was prepared.

[0065] On the multicolor heat-sensitive recording layer prepared by (D1), calender processing of the coating liquid for overcoat stratification prepared by (C7) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0066] The homogenizer ground the 10% polyvinyl alcohol water-solution 40 of preparation section of the coating liquid for example of comparison 2 (C8) overcoat stratification, the glyoxal denaturation object 2 section of polyacrylic acid, the calcium-carbonate 15 section, the 40% low consistency polyolefine dispersion-liquid (Mitsui Chemicals make: CHEMIPEARL M200, mean particle diameter of 6 micrometers) 45 section, and the water 60 section, and the coating liquid for overcoat stratification was prepared.

[0067] On the multicolor heat-sensitive recording layer prepared by (D1), calender processing of the coating liquid for overcoat stratification prepared by (C8) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0068] The 30% urethane resin (Dai-Ichi Kogyo Seiyaku make: super FREX 200, Tg:-40 degree C) 60 of adjustments section of the coating liquid for example of comparison 3 (C9) overcoat stratification and the dispersion-liquid 100 section which grinds the calcium-carbonate 30 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 70 section 2%, and is obtained were mixed, and the coating liquid for overcoats was prepared.

[0069] On the multicolor heat-sensitive recording layer prepared by (D2), calender processing of the coating liquid for overcoat stratification prepared by (C9) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0070] The 30% urethane resin (Dai-Ichi Kogyo Seiyaku make: super FREX 200, Tg:-40 degree C) 60 of adjustments section of the coating liquid for example of comparison 4 (C10) overcoat stratification and the dispersion-liquid 100 section which grinds the calcium-carbonate 30 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 70 section 2%, and is obtained were mixed, and the coating liquid for overcoats was prepared.

[0071] On the multicolor heat-sensitive recording layer prepared by (D2), calender processing of the coating liquid for overcoat stratification prepared by (C10) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0072] The 49% SBR RATEKKUFFU (Nippon Zeon make: NIPORU LX430, Tg:12 degree C) 60 of

adjustments section of the coating liquid for example of comparison 5 (C11) overcoat stratification and the dispersion-liquid 100 section which grinds the calcium-carbonate 30 section with a homogenizer with the hexametaphosphoric acid sodium water-solution 70 section 2%, and is obtained were mixed, and the coating liquid for overcoats was prepared.

[0073] On the multicolor heat-sensitive recording layer prepared by (D2), calender processing of the coating liquid for overcoat stratification prepared by (C11) was carried out so that the amount of solid content coating might serve as 1.5 g/m², and the Beck smoothness of a coating side might become 600 - 800 seconds, after drying, coating, and the thermal recording medium was produced.

[0074] Trial 1 The sensible-heat facsimile printing testing machine (TH-PMD) made from the Okura electrical machinery with the TDK print head (LH4409) was used for the thermal recording medium of the thermal recording trial examples 1-6 and the examples 1-5 of a comparison, and high energy printing (black printing) was performed by the applied voltage of 20 volts, and impression pulse 2.0 ms. Moreover, low energy printing (red printing) was performed to the thermal recording medium of examples 1-2, examples 4-6, and the examples 1-5 of a comparison by the applied voltage of 20 volts, and impression pulse 1.0 ms. The result of having observed sticking at the time of printing, printing dregs, and a quality of printed character by viewing is shown in Table 1.

[0075] Trial 2 After putting the hot printing ink ribbon on the coating side of the thermal recording medium of the thermal-transfer-recording trial examples 1-6 and the examples 1-5 of a comparison and heating by the applied voltage of 20 volts, and impression pulse 0.8 ms like a thermal recording trial, the ink ribbon was removed and the quality of printed character of an image was observed by viewing. The result is shown in Table 1.

[0076] Trial 3 After having carried out the load of each three test pieces so that it might become superposition and 150 g/cm², and exposing them to the environment of 40 degrees C and 90% of humidity RH for 24 hours about the thermal recording medium of the blocking trial examples 1-6 and the examples 1-5 of a comparison, one sheet exfoliated at a time and the condition of a coating side and a rear face was observed by viewing. The result is shown in Table 1.

[0077]

[Table 1]

	感熱記録				熱転写記録	ブロッキング
	印字品質		スティッキング	カス	印字品質	
	赤	黒				
実施例 1	◎	◎	◎	◎	◎	◎
実施例 2	◎	◎	◎	◎	○	◎
実施例 3	—	◎	○	◎	◎	○
実施例 4	◎	◎	◎	◎	◎	◎
実施例 5	◎	◎	○	◎	◎	○
実施例 6	◎	◎	◎	◎	○	◎
比較例 1	◎	◎	◎	◎	×	◎
比較例 2	◎	◎	◎	◎	△	◎
比較例 3	◎	◎	○	◎	△	△
比較例 4	○	△	×	△	○	△
比較例 5	○	△	△	○	△	○

[0078] The following valuation basis estimated the thermal recording trial in Table 1.

(1) Quality-of-printed-character O : the repeatability of a dot is extremely excellent.

O : the repeatability of a dot is good.

** : The repeatability of a dot is inferior and it is inadequate for practical use.

x : The repeatability of a dot is very bad and is not suitable for practical use.

(2) Sticking O : there is no printing sound and excel extremely.

O : although there is a printing sound, there is no effect on an image.

** : It has the influence on a printing sound and an image slightly, and it is inadequate for practical use.

x : It is [a printing sound and a white kite of an image] and is not practical.

(3) Dregs O : there is no adhesion of dregs and excel extremely.

O : although there is adhesion of dregs, there is no effect on printing.

** : There is adhesion of dregs, and it has the influence on printing slightly, and is inadequate for practical use.

x : Dregs adhere, and it has the influence on printing, and is not suitable for practical use.

[0079] The following valuation basis estimated the thermal-transfer-recording trial in Table 1.

(1) Quality-of-printed-character O : the repeatability of a dot is extremely excellent.

O : the repeatability of a dot is good.

** : The repeatability of a dot is inferior and it is inadequate for practical use.

x : The repeatability of a dot is very bad and is not suitable for practical use.

[0080] The following valuation basis estimated the blocking trial in Table 1.

O : a test piece separates very easily.

O : a test piece separates easily.

** : A test piece cannot separate easily and there is exfoliation of a coating side slightly.

x : A test piece cannot separate easily and a coating side is not suitable for dropping practical use.

[0081] Among Table 1, the thermal recording medium of examples 2 and 6 was level which is satisfactory practically, although the inclination for the quality of printed character at the time of thermal transfer recording to deteriorate slightly was seen probably because it was comparatively high and Tg of the resin used for the overcoat layer became [a coat] hard. On the other hand, although the printing sound generated slightly the thermal recording medium of examples 3 and 5 at the time of thermal recording probably because it was comparatively low and Tg of the resin used for the overcoat layer became [a coat] soft, there was no effect on an image and it was the level which is satisfactory practically. Moreover, at the time of thermal transfer recording, probably because adhesion with a hot printing ink ribbon was high, the very good printing property was shown. Furthermore, in the blocking trial, although the ball up of a test piece arose, it could remove easily, without producing exfoliation of a coating side, and was the level which is satisfactory practically. As mentioned above, the thermal recording medium of examples 1-6 is excellent in the recording characteristic of both thermal recording and thermal transfer recording, and showed the result of moreover having excelled also in the blocking property.

[0082] Although the good result was shown in the thermal recording trial in the example 1 of a comparison since the overcoat layer for thermographic recording papers was prepared, in the thermal-transfer-recording trial, a result to which hot printing ink acceptance nature is not deficiently suitable for practical use was brought. The example 2 of a comparison of the quality of printed character at the time of thermal transfer recording was inadequate for practical use, although the binding property with hot printing ink was using the good polyolefine system resin particle.

[0083] Since acrylic resin with comparatively low Tg was used for an overcoat layer in the example 3 of a comparison, although the printing sound occurred at the time of thermal recording, there was no effect on an image. However, since the polyolefine system resin particle was not used for an overcoat layer, the binding property with hot printing ink was inadequate, and a result unsuitable for practical use was brought. Moreover, a result which the ball up of a test piece produces also at the time of a blocking trial, and omission of a coating side produce at the time of exfoliation was brought.

[0084] In the example 4 of a comparison, since the low urethane resin of Tg is used for an overcoat layer, although the quality of printed character of practical use level is obtained at the time of thermal transfer recording, since polyolefine system resin was not used, sticking was produced at the time of thermal recording, and a result unsuitable for practical use was brought. Moreover, also in the blocking trial, the ball up of a test piece arose and omission of a coating side arose at the time of exfoliation.

[0085] In the example 5 of a comparison, although the SBR latex with comparatively high Tg was used for the overcoat layer, since the polyolefine system resin particle was not used, sticking was produced at the time of thermal recording, printing KAKE of a thin line was produced at the time of thermal transfer recording, and a result unsuitable for practical use was brought.

* NOTICES *

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, the thermal recording medium of this invention can be recorded without producing sticking, printing dregs, etc. at the time of thermal recording, and, moreover, is extremely excellent in the repeatability of a dot. Moreover, in thermal transfer recording, ink acceptance nature is extremely excellent in the repeatability of a dot well, and does not cause blocking. Therefore, it can respond to two recording methods, thermal recording and thermal transfer recording, with a single record medium by using the thermal recording medium of this invention.

[Translation done.]